INTERSTITIAL KERATITIS

FROM A

MODERN STANDPOINT.

By SYDNEY STEPHENSON, M.B., C.M.,
Editor of "The Ophthalmoscope".

A CONTRIBUTION TO THE DISCUSSION ON INHERITED SYPHILIS AT THE SOCIETY FOR THE STUDY OF DISEASE IN CHILDREN ON DECEMBER 18TH, 1907.

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INTERSTITIAL KERATITIS FROM A MODERN STANDPOINT.

It would be difficult or impossible to over-estimate the diagnostic importance which attaches to some of the ocular stigmata of inherited syphilis. By their discovery the nature of many and many an obscure case has been cleared up. I can recall a couple of cases of necrosis, recognised as syphilitic in one instance by the finding of disseminated choroido-retinitis, and in the other by the advent of interstitial keratitis. The most striking case with which I am acquainted, however, was related by Edmond Fournier in his monograph on late heredito-syphilis (*Recherche et Diagnostic de l'hérédo-syphilis tardive*, 1907, p. 325). A man, æt. 34, was believed to be suffering from sarcoma of the pelvis, declared by three competent hospital surgeons to be beyond the reach of operation. The patient's elder brother, æt. 36, was examined by my friend Dr. Antonelli with the ophthalmoscope, and found to be affected with positive stigmata of congenital syphilis. The result of this discovery was happy in the extreme. For after two months' treatment by mercurial injections and potassium iodide, the pelvic growth disappeared without leaving a trace and the patient was restored to perfect health. His remark was amply justified when he exclaimed: "*J'ai été sauvé par les yeux de mon frère.*"

Of all the ocular manifestations of inherited syphilis, none is better known or easier to recognise than diffuse interstitial or parenchymatous keratitis.

The disease is not exactly a common one. For example, Greeff, (*Die Keratitis interstitialis in ihren Beziehungen zu Allgemeinerkrankungen*, 1897) collected figures respecting 36,385 eye patients, and found that interstitial keratitis had been diagnosed in 297—*i.e.*, in 0.77 per cent. of the total number. Again, among 5,142 eye patients seen by me at the North-Eastern Hospital for Children, London, 49, or 0.95 per cent. were affected. The proportion would naturally be somewhat higher at a children's hospital than elsewhere.

The disease has been familiar to surgeons for many years. William Mackenzie (*A Practical Treatise on the Diseases of the Eye*, 1830, p. 419), who takes in ophthalmic science the position occupied by Sir Thomas Watson in general medicine, was acquainted with the malady, which was called by him "scrofulous corneitis." Mackenzie noted its coincidence with deafness, a peculiar hoarseness of voice, swollen lymphatic glands, nodes on the tibiæ, and effusion into the bursa beneath the tendon of the extensores cruris, symptoms some of which we now recognise to be manifestations of inherited syphilis.

It was, however, reserved for Jonathan Hutchinson (*A Clinical Memoir on Certain Diseases of the Eye and Ear, consequent on Inherited Syphilis*, 1863) to show that interstitial keratitis was "almost always a direct result of inherited syphilis," and to give a description of its clinical characters and morbid associations that is as accurate to-day as when he wrote it forty-four years ago. In particular, Hutchinson drew attention for the first time to the diagnostic value of certain malformations of the teeth often met with in cases of interstitial keratitis.

A few years later James Dixon (*A Guide to the Practical Study of Diseases of the Eye*, third edition, 1866, p. 95) went farther, and proposed to substitute for Hutchinson's name, "chronic interstitial keratitis," that of "syphilitic keratitis," since there existed, he said, "no special form of keratitis connected with acquired syphilis."

Still more recently, Hutchinson (*Syphilis*, London, 1889, p. 75) has claimed that "interstitial keratitis in its typical form is always a consequence of syphilis, and is in itself sufficient for the diagnosis."

To some extent, however, the pendulum of professional opinion has now swung back to the views expressed so many years ago by William Mackenzie. The view current to-day, especially upon the Continent, is, that while parenchymatous keratitis is usually a manifestation of inherited syphilis, yet a proportion of the cases are due to other factors, among the more important of which are tuberculosis, acquired syphilis, influenza, malaria, and trypanosomiasis. In a word, it will scarcely be denied that interstitial keratitis is the local manifestation of some general disorder, be it syphilis or otherwise.

It will clear the ground if a few figures be quoted as

to the relative frequency of inherited syphilis as a cause of interstitial keratitis. Davidson found 20 per cent., Alexander 35.3 per cent., Fournier 41.5 per cent., Michel 55 per cent., Hirschberg 61 per cent., Sæmisch 62 per cent., Horner 64 per cent., Mauthner 80 per cent., Bosse 81 per cent., and Silex 83 per cent. of the cases to be due to a specific cause in the shape of inherited syphilis. Pfister (*Klin. Monatsbl. f. Augenheilkunde*, XXVIII., 1890, p. 114) found certain evidence of hereditary lues in 40.8 per cent. of his 130 cases and presumptive evidence in 23.8 per cent.—total, 64.6 per cent. Nettleship (*Diseases of the Eye*, fifth edition, 1890, p. 120) found personal (54 per cent.) or family (14 per cent.) evidence of inherited syphilis in 68 per cent. of an unspecified number of cases, and in most of the remaining 32 per cent. there were strong reasons for suspecting its existence. My own figures, which deal with 101 cases, give inherited syphilis in 70, or 69.3 per cent.

Other statistics might readily be quoted, but enough have been given to show that, broadly speaking, adequate evidence of inherited syphilis may be obtained in about two-thirds of all cases of parenchymatous keratitis.

With regard to the frequency of tuberculous interstitial keratitis, some interesting figures have recently been published by H. Rabiger (ref. in *Archives of Ophthalmology*, November, 1907, p. 875). In 349 cases of keratitis observed at the University Polyclinic at Berlin, tuberculosis was found with certainty in 11 per cent., and with probability in 9.7 per cent.—total, 20.7 per cent. In my own series of 101 cases tuberculosis was identified as the cause of the keratitis in 10—that is, in 9.90 per cent. The more extended employment of Calmette's serum test will doubtless help us to recognise such cases with more certainty.

It would appear that interstitial keratitis is by no means rare as a late, tertiary consequence of acquired syphilis. The connection was first mentioned by Velpeau in 1840 (*Maladie des Yeux*), and was described in 1861 by Follin (*Pathologie Externe*, T. I., p. 708, 1861)—that is to say, two years before the publication of Hutchinson's famous memoir in which he commented on "the entire absence of interstitial keratitis from the *rôle* of tertiary symptoms of acquired syphilis" (*loco. citato*, p. 221). In a later work (*Syphilis*, 1889, p. 237), however, Hutchinson modified this view, and

recognised the possibility of an acquired interstitial keratitis.

According to figures collected by Pfister from Professor Haab's klinik (*loco citato*), of 130 cases of keratitis 3.8 per cent. (2.3 per cent. certain and 1.5 per cent. somewhat doubtful) were due to the acquired disorder, while Ancke (*Centralbl. f. prak. Augenheilkunde*, 1885, p. 360) found the proportion in 100 cases to be as high as 10 per cent. Again, Alexander (*Syphilis und Auge*, 1889, p. 201) in a series of 102 cases of interstitial keratitis, had 13, or 12.6 per cent., due to acquired syphilis. Among my series of 101 cases of parenchymatous keratitis, 4, or 3.96 per cent., were unquestionably due to acquired syphilis.

It is important to note that such cases have been met with even in children. For example, Mauthner (Zeissl's *Lehrbuch der Syphilis*, p. 279) saw a case of interstitial keratitis in a suckling that had contracted syphilis from its nurse. Moreover, Trousseau (*Annales d'oculistique*, September, 1895, p. 206) has mentioned the case of a boy, æt. 8, who was infected by his nurse with syphilis. The result was a very severe attack of bilateral keratitis. Lastly, I reported a case of the kind (*The Ophthalmoscope*, Vol. I, 1903, p. 169) in a girl, æt. 12, who had suffered from a chancre on one upper eyelid two or three months after birth.

It may be noted as an interesting point that quite a number of cases of interstitial keratitis have been known to follow an indurated chancre on the eyelid or conjunctiva.

After what has been said it will be admitted that acquired syphilis is an important and a not very infrequent cause of interstitial keratitis.

The name "interstitial keratitis" is good in so far as it directs attention to a prominent feature of the malady—namely, to opacities "like microscopic masses of fog," situated at various levels in the substance of the cornea. It suggests, nevertheless, a mistaken view as to the pathology of the condition (Fuchs, v. Hippel, Pflüger, de Lapersonne, C. D. Marshall, Parsons, &c.). The available evidence indicates that the ailment is primarily an inflammation of the tissues of the ciliary body, which forms (as everybody knows) the middle part of the uveal tract, of which the other parts are the iris and the choroid. From the ciliary body inflammation spreads forwards to the iris as well as to the deeper layers of the cornea,

and backwards to the anterior parts of the choroid. Keratitis and the commonly associated choroiditis and iritis, therefore, are, strictly speaking, conditions secondary to an inflammation of the ciliary body. The underlying process may conveniently and accurately be described by the expression " anterior uveitis."

If this view be not grasped, it becomes difficult to understand some clinical features of the disease. For example, in my experience, it is not very uncommon for the ailment to begin with what appears to be an accumulation of pus in the anterior chamber of the inflamed eye (*a*). This hypopyon, of course, represents an exudation from the inflamed ciliary body, which has passed through the pupil and has thereby gained the anterior chamber. Another early sign is the existence of deposits on Descemet's membrane, the " aquo-capsulitis " of the older, and the " keratitis punctata " of the more modern, writers, and this, again, is to be regarded as the expression of an exudation from the ciliary body. The occasional bleeding into the anterior chamber (hyphæma), which may usher in an attack of parenchymatous keratitis, is almost certainly due to the rupture of some small distended vessel in the ciliary body. None of these appearances can be explained on the theory that the disease is primarily one of the cornea.

Further, the iritis or scleritis, which often precedes or accompanies the keratitis, can be best accounted for by an extension forwards from an inflamed ciliary body.

A similar remark applies equally to the choroiditis which is frequently found when the cornea has cleared enough to allow of an examination of the fundus with the ophthalmoscope. In cases where choroiditis is known to precede by months or years the development of keratitis, the backward extension to the choroid has antedated the forward extension to the cornea, or has possibly occurred independently of the ciliary inflammation. Cases of this type are sometimes of an unusually severe type. The following is an example : John O——, æt. 8, first seen on January 5th, 1893. A typically syphilitic subject, with " bossy " forehead, rhagades, and dwarfed and notched upper central incisors, and a tendency to ptosis. Sight equalled

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(*a*) Hypopyon was present in 4 of my 97 cases of Interstitial Keratitis ; that is, in 4·12 per cent.

about one-fifth of the normal, as the result of widely-spread, bilateral choroido-retinitis. In September, 1893, the right eye developed interstitial keratitis, and seven months later (April 25th, 1894) the left eye followed suit. On May 30th each knee-joint became distended with fluid. The corneæ presented a peculiar appearance, since an irregular area towards the centre, 5 mm. at its widest part, resembled damp wash-leather, and was everywhere surrounded by a zone of plum-coloured vascular tissue—a confluent "salmon patch," in short. Viewed from the side, the cornea projected forward cone-wise, the blunt apex of the cone being formed by opaque cornea and its sides by the vascular patch. By this time the lad had become somewhat deaf, without discharge from the ears. On June 19th, a portion of the grey opaque central area had exfoliated. Deafness was increasing. Both ankles had become swollen. In August, 1894, the lad developed delusions, which became very pronounced towards the end of that month. He used vile language, insisted upon getting out of bed for the express purpose of breaking the windows of the ward or, for that matter, anything else he could grope his way to, for by this time he was, to all intents and purposes, blind. John O——, was then transferred from the Ophthalmic School to another institution, where "he developed most acute mania, and had delusions that people were coming to kill him and that there were bloodhounds in the cupboard." In 1902—that is, nine years after I first saw him—the patient was an inmate of Darenth Asylum, quite blind, and suffering from imbecility with occassional attacks of excitement. One of his eyes had been removed owing to an injury.

The case just described presented several peculiarities, and amongst them ulceration of one cornea. This complication, in my experience, is not common. For instance, among my 97 cases (*a*) of interstitial keratitis it occurred in 4—that is to say, in 4.12 per cent. In one instance ulceration was preceded by the formation of a bulla on the cornea, a condition first described by v. Graefe (*Arch. f. Ophthalmologie*, Bd. II, 1.) That ulceration might occur was known to Hutchinson, who alluded to one or two cases on page 29, of his oft-quoted memoir. W. Spencer Watson

(*a*) Four cases due to acquired syphilis omitted.

(*Ophthalmic Hospital Reports*, Vol. IV, p. 296), writing a few years after Hutchinson, reported an instance of unilateral ulceration observed in a series of twenty-five cases of interstitial keratitis. R. Ancke (*Centralb. f. prak. Augenheilkunde*, 1885, p. 296) had one example of ulceration among 100 cases of interstitial keratitis. E. T. Collins (*Ophthalmic Hospital Reports*, Vol. XI, 1887), described four cases in corneæ which showed extreme vascularity, and in which a small central island of non-vascular tissue was alone left. This islet became yellow and then ulcerated. In one of Collins' cases there was perforation, but cicatrisation took place in the other three. His patients showed unmistakable signs of inherited syphilis, either in the teeth or the physiognomy.

In a majority of cases of parenchymatous keratitis, one cornea is first attacked and the other cornea, according to Hutchinson, "after from one to two months." But it should be borne in mind that the interval may be and often is much longer than this. The extreme instance reported by Consiglio (*Beitrage z. Augenheilkunde*, May, 1905), where the interval amounted to twenty-six years, must be almost unique, although in his case the evidence of inherited syphilis was not altogether conclusive. My own series includes one case where the interval amounted to about seven years, The facts follow:—Edmund D——, æt. 13, seen on December 22nd, 1899, with early interstitial keratitis affecting the right eye, which had been divergent since infancy. After making a nearly complete recovery, the right eye relapsed in September, 1905. On November 30th, 1906, the following note was made: "The left eye has been affected for the last fortnight—*i.e.*, there has been an interval of seven years between the attacks in the two eyes. The patient is deaf and his teeth are typical of inherited syphilis. Hutchinson's triad is therefore present."

All observers agree that parenchymatous keratitis is essentially a disease of childhood. On this point there is no difference of opinion. It is, nevertheless, relatively rare in very young children, and almost equally so after mature age has been reached. Hutchinson, for example, had never witnessed its occurrence earlier than two years or later than twenty-six years. It is most frequent between the ages of five and eighteen years (Hutchinson), or of six and fifteen years (Nettleship).

The age-incidence of my 97 cases, arranged in quinquennial periods, comes out as follows :—

Period.	Number.	Percentage.
1 to 5 years	6	6.19
5 to 10 ,, ...	38	39.18
10 to 15 ,, ...	26	26.80
15 to 20 ,, ...	14	14.43
20 to 25 ,, ...	8	8.25
25 to 30 ,, ...	2	2.06
Over 30 ,, ...	3	3.09

An inspection of the foregoing figures will at once show that of my 97 cases, four-fifths, or 80.41 per cent., occurred between the ages of 5 and 15 years. The greatest incidence (39.18 per cent.) occurred between the ages of 5 and 10 years. My series includes one case in a woman, æt. 36, whose syphilitic inheritance was attested by notched upper central incisors, rhagades at angles of the mouth, and by a node on the frontal bone, one inch above the inner end of the left eyebrow. R. Marcus Gunn (*The Polyclinic*, December, 1902) reported a case in a patient, æt. 36 ; Pfister (*loco citato*) in a man æt. 37½ ; and Greeff (*loco citato*, p. 13) in a man of 38 years.

The rule that syphilitic parenchymatous keratitis is relatively commoner in females than in males, is supported by an analysis of my own cases, 97 in number. Of the total, 37 (38.14 per cent.) were in males, and 60 (61.86 per cent.) in females. It is perhaps worth noting that the same curious disproportion between males and females applies also to another syphilitic affection, juvenile tabes dorsalis. Thus, Cantonnet (*Archives d'ophtalmologie*, November, 1907), as the result of an analysis of 88 cases, found that females were affected in 63.6 per cent., and males in 37.3 per cent.

It should be noted that the figures given by Baker and Story (*Ophthalmic Review*, November, 1885), and by Ancke (*Centralbl. f. prak. Augenheilkunde*, 1885, p. 360) respectively form an exception to the general experience as to the age-incidence of keratitis, as stated above.

The discovery of the specific cause of syphilis in the shape of the treponema pallidum, together with the possibility of inoculating apes, rabbits (*a*), and dogs

(*a*) As long ago as 1881 Paul Haensell (v. Graefe's *Archiv f. Ophthalmologie*, XXVII, III, p. 93) showed that syphilitic virus could be successfully inoculated into the iris and cornea of the rabbit

with the virus, has widened our conception of the morbid processes that lead up to the development of interstitial keratitis. The disease in question has been produced experimentally in certain animals by the implantation of syphilitic products. Indeed, prior to the discovery of the treponema, P. Salmon (ref. in *Archives d'ophtalmologie*, April, 1905, p. 1623) observed iritis and keratitis thirty-three days after a monkey had been inoculated with a syphilitic papule from man.

We know that the tissues and organs of the syphilitic fœtus or baby are literally flooded with the treponema, large numbers of which have been found in the placenta, the umbilical cord, the blood of the umbilical vein, and especially the liver. The organisms that escape the liver are distributed by the fœtal circulation to every part of the body, where they determine this or that syphilitic lesion. The treponema has been found in cutaneous lesions, as pemphigus, by Levaditi and others; in perioral ulcerations by Elizaldi and Wernicke; in glandular lesions by Panea and Babes. That is by no means all, for apart from definite lesions such as those named, the treponema had been found in every internal organ so far examined with the microscope. As regards the eye, the findings from our present point of view are highly suggestive. Thus, Hans Bab (*Deutsche med. Wochenschrift*, November 29th, 1906) examined the eyes of three specific still-born babies. Preparations were treated by the silver impregnation method, and large numbers of the spirochætes were found in all the tissues of the eye, with the exception of the vitreous humour and the crystalline lens. It is important to note that the cornea contained a large number of the organisms. Again, H. Schlimpert (*Ibid.*, 1906, p. 1942) succeeded in discovering the treponema in various parts of the eyes of syphilitic fœtuses. Lastly, spirochætes have been demonstrated in the tissues of seemingly unaffected eyes of syphilitic fœtuses and babies by some other observers, including Peters, Gierke and Stock, and myself.

It would thus seem probable that if the child survive, these micro-organisms (possibly in some different morphological form) lie dormant in the tissues of the eye, more especially in the ciliary body and the cornea, They cause no mischief until some exciting cause. of a local or general nature, lowers the resistance of

the part, and allows the treponema to come into action. The result is an attack of interstitial keratitis.

In this view we can explain an observation made by many surgeons—namely, that a slight injury to the eye may precipitate an attack of parenchymatous keratitis. I well remember the first case of this kind that happened in my practice. A girl, æt. 11, was admitted to the Ophthalmic School, Hanwell, W., for trachoma, pannus, and lead opacities of each cornea, in consequence of which the child was almost blind. Her syphilitic diathesis was attested by: (1) notched central incisors of the upper jaw; (2) scars radiating from the mouth, the so-called "Fournier's cicatrices"; (3) "epithelial denudations" (*a*) about the skin of the upper lip and nose; (4) slightly enlarged lymphatic glands; and (5) cicatrices about the anus and buttocks, the so-called "Parrot's cicatrices." On March 16th, 1897, under cocaine, the metallic incrustations were more or less scraped away from the right cornea by means of a small, sharp scoop. The little operation, somewhat to my surprise, was followed by redness of the eye, and by increased haziness and vascularity of the cornea—in a word, by the clinical appearances of an ordinary parenchymatous keratitis. On May 4th—that is, forty-nine days after the operation—the condition was typical of interstitial keratitis. In view of etiology, the case was an interesting one, and so on June 16th, the operation was repeated on the other eye. I am bound to add that the second intervention was not followed by interstitial inflammation. Be that as it may, the association between slight injury to the eye, on the one hand, and parenchymatous inflammation, on the other, is far from uncommon, as will be obvious from the fact that I possess notes of fifteen such cases.

Interstitial keratitis may supervene during the course of illnesses, such as influenza and typhoid fever. Here are one or two cases in point:—

Ellen W., æt. 11, was admitted to the North-Eastern Hospital for Children under my colleague, Dr. James Taylor, on account of typhoid fever. On the seventeenth day of the fever (approximately) the left pupil was noticed to be contracted and the cornea of the left

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(*a*) The expression "epithelial denudation" I apply to those superficial cicatrices, whose favourite site is at the junction of the ala nasi with the upper lip. Their significance and diagnostic value are the same as Fournier's cicatrices.

eye rather dull. When seen by me five days later, there could be no doubt that the case was one of parenchymatous keratitis. The girl had suffered from periostitis of the right tibia for several weeks. Three months after the first eye had been attacked, the other cornea went through a much milder attack of keratitis. Florence G——, æt. 8, a child who presented rhagades at the angles of the mouth, a *café au lait* complexion, and suspicious incisor and molar teeth, in addition to slight deafness, was brought to the Evelina Hospital on March 15th, 1905, for a relapsed interstitial keratitis of her right eye. The history was to the effect that three years before, about a fortnight after her discharge from an Asylums Board Hospital, where she had spent three months on account of enteric fever, both eyes became inflamed, one soon after the other. The condition had slowly improved until a relapse a few weeks before the child was brought to me.

I have also seen interstitial keratitis follow a whitlow so closely as to suggest a connection between the two affections.

It is now, I think, generally recognised that interstitial keratitis may relapse—or, more correctly, recur—in one and the same patient. Manasse, in 50 cases had 8 recurrences, or 16 per cent., and v. Hippel, among 87 cases, 15 recurrences, or 17.25 per cent. The proportion in my own cases, many of which remained under observation for long periods of time, was, as might be expected, somewhat higher, namely, 22 per cent. As to the explanation of recurrences, we must assume that spirochætes have remained dormant in the tissues of the cornea as a sequel of the primary attack. I believe that recurrences are commoner in cases originally treated without than with mercury, and I am confident that, as a rule, they are more difficult to manage than that original attack.

Experimental Keratitis.—Bertarelli (*Presse Médicale*, August 22nd, 1906) obtained a positive result by inoculating the cornea of rabbits with an emulsion of human chancres. The animals' corneæ showed numerous spirochætes, and, in addition, a pronounced leucocytic infiltration, which extended into the seemingly unaffected parts of the cornea. Scherber and v. Benedek (*Münch. med. Wochenschrift*, June 14th, 1906) produced nodular iritis and interstitial keratitis by inoculating the anterior chamber of rabbits with

syphilitic virus. Most suggestive experiments were reported during the course of 1906 by Greeff and Clausen (*Bericht der Oph. Gesellschaft*, Heidelberg, 1906), who inoculated the eyes of apes and rabbits with syphilitic material, and after the lapse of some weeks, observed the development of a kind of parenchymatous keratitis. In the earlier cases, numerous spirochætes could be demonstrated, but the organism could not be found in the more advanced cases. The authors concluded that the corneal opacity was the outcome of a leucocytic invasion, which first attacked and eventually destroyed the micro-parasite.

In a second communication (*Deutsche med. Wochenschrift*, 1906, No. 36), Greeff and Clausen concluded that the pathogenic agents of syphilis multiplied in the cornea, and thus caused an invasion by leucocytes, which finally exterminated the micro-organisms, Lastly, Hoffmann and Bruening (*Deutsche med. Wochenschrift* April 4, 1907) produced keratitis by the inoculation of a rabbit's eye with a morsel of a human chancre, and obtained a somewhat similar result when an emulsified chancre was introduced into the anterior chamber. Smears from the diseased cornea, when stained by Giemsa's method, showed the spirochæta pallida, thereby proving the essentially syphilitic nature of the keratitis.

Panas (*Archives d'ophtalmologie*, 1871, p. 577) taught that interstitial keratitis was a dystrophic symptom, the indirect cause of which was to be sought, not only in ancestral syphilis but also in lymphatism, scrofula, gout, and arthritism. It is now suggested, mainly as the result of experimental and histological researches, that it is, in reality, an infection of the tissues of the cornea with this or that specific organism, the most important of such being the treponema pallidum, the tubercle bacillus, the B. influenzæ, the plasmodium malariæ, and the parasite of trypanosomiasis.

As regards trypanosomiasis, in dogs and goats suffering from nagara and dourine, diseases closely allied to if not identical with sleeping sickness, interstitial keratitis is the commonest eye affection. The changes have been shown by Morax (*Annales d'oculistique*, December, 1906) to be due in these animals to the growth of the parasite in the interlamellar spaces of the cornea.

In brief, it can nowadays scarcely be doubted that syphilitic interstitial keratitis is due to the presence in

the parenchyma of the cornea of the causal agent of syphilis. The treponema, however, has yet to be demonstrated in that structure. The hiatus on this vital point is not to be wondered at, since eyes are seldom, if ever, removed during the height of parenchymatous keratitis, nor do patients usually die during the course of that affection. Speaking for myself, I have failed to find the spirochæta in scrapings from eyes affected with keratitis ; but, then, superficial parts only were removed. Despite the known difficulty of recognising the treponema in tertiary syphilitic lesions, it is safe to predict that sooner or later the organism will be discovered in the tissues of the cornea. The chain of evidence, which still lacks one link, will then be complete.

Aphorisms Respecting Interstitial Keratitis.

1. Interstitial keratitis does not form more than 1 per cent. of the cases met with in a special department for diseases of the eye.

2. It is not a primary affection of the cornea, but is probably in every instance secondary to changes in the anterior part of the uveal tract.

3. The disease is nearly twice as frequent in females as in males.

4. Four-fifths of the cases occur between the ages of five and fifteen years.

5. The disease can be shown in about two-thirds of all cases to be associated with signs of inherited syphilis, of which the commonest are the dental, facial, and ocular stigmata. Other important causes of the disease are tuberculosis, acquired syphilis, influenza. malaria, and (in animals) sleeping sickness.

6. Given a predisposing cause, the affection may be excited by almost anything that lowers resistance, local or general.

7. Ulceration of the cornea occurs in a notable percentage of all cases.

8. The ailment is bilateral in three-fourths of the cases. The interval between the two eyes being attacked may, however, run into several years.

9. Recurrences occur in perhaps one-fifth of the cases, are commoner in cases treated without than with mercury, and are often very difficult to manage.

10. The disease is due to the lodgment and multiplication in the cornea of the treponema pallidum derived primarily from the uveal tract.